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ABSTRACT

The report covers a series of investigations on the effects of biofeedback/muscle relaxation training on the academic achievement of learning disabled (LD) students. In the first study, 32 LD elementary school students made gains in all measures except arithmetic following electromyograph biofeedback/relaxation treatment. Implementation of the program with 30 language LD elementary school children yielded significant gains over controls on all dependent measures except Slosson IQ and auditory memory. The relaxation program was then incorporated as a major delivery system of the Diagnostic Education Center with 358 children over a 3 year period. As a result of treatment, significant gains were made on all dependent measures except arithmetic. A pilot investigation with four LD boys supported the theory that in the normally functioning child, the left hemisphere shifts as needed from the resisting state of 8-13 Hz activity to the sustained attention state involving the beta range 13-28 Hz: that children who perform poorly on verbal, logical, and sequential tasks as compared to their average level of ability to perform right hemisphere tasks involving spatial and holistic processing, would be expected to have difficulty in making this shift. Implications of a study with 20 LD Ss were that there is a specific hemispheric relationship with intellectual abilities and educational attainment. (SB)

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Use of Biofeedback/Relaxation Procedures with Learning Disabled Children

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This report covers a series of investigations concerning the effects of biofeedback/muscle relaxation training during the past few years.

The rationale of the biofeedback/relaxation training involves the idea that learning is most effective when the child is physically relaxed and mentally attentive. For many children manifesting academic learning problems, attending school daily and performing poorly results in their experiencing a physiological response often called the "emergency" or "fight or flight" reaction. When an individual, adult or child, feels physically or psychologically threatened, a characteristic pattern of arousal occurs as a preparation for dealing with that perceived threat. This pattern includes (but is not limited to) heightened muscle tension, more rapid breathing, increased heart rate, increased cerebral and large muscle blood flow, decreased peripheral blood flow, increased endocrine activity and a decrease of digestive action. This autonomic arousal pattern, which is and has been a species survival characteristic, prepares the person to respond to the perceived threat.

If either running or fighting is inappropriate or impossible for a child then there is no way for this heightened level of arousal to dissipate except over time. Sheer (1977) has shown that learning disabled children show much more autonomic lability and inability to focus attention than do normal controls. If the threat or stress persists then a chronically high and fluctuating internal activity level will be maintained. The investigators feel that attending school daily and performing consistently poorly is a source of considerable stress.

Although the possibility of teaching direct control over this autonomic "fight or flight" response is relatively new, biofeedback training has been

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developed as a means of teaching individual control over these physiological responses. Exploratory work, using small numbers of children, suggests that children can also learn such control.

The specific procedures presented here were developed in a pilot investigation (Carter and Russell 1978), with four learning disabled boys. Since these results indicated significant gains in reading, spelling and handwriting legibility for a small sample it was decided to maintain the same experimental procedures for more controlled investigations. The same treatment plan was followed in all investigations presented here.

After identification and selection, children were randomly placed in two groups of eight, experimental and control. Treatment consisted of getting the children settled into the room and listening to a pre-recorded audio tape consisting of visual imagery relaxation exercises of 10 minutes duration. Then, the children were given individual packets of handwriting exercises to practice. During the rest of the hour the children were taken individually by graduate assistants and attached to an Autogen 1500 Electromyograph (EMG) for biofeedback/muscle relaxation training. Each subject was trained individually in a separate room for 10 minutes.

Electrode leads were attached externally on the flexor muscle of the preferred writing forearm. The Autogen 1500 EMG was connected to an Autogen 5100 Integrator which was preset to visually display the accumulative mean of two-minute intervals. Five two-minute interval readings were recorded for each subject during each of the 10 training sessions. The subjects faced the instrument, were made aware of the visual display, and asked to relax their arms and to keep the visual reading as low as possible. No reinforcement or reward system was used other than what many have been intrinsic to the situation. This procedure was followed twice a week for five weeks.

In addition, the children were given a set of pre-recorded audio tapes utilizing passive muscle relaxation and instructed to use them at home three nights per week. Each exercise was 10 minutes long.

All pre and post testing was done by graduate students who were not involved in the investigation. The examiners were unaware of group placement of the child being tested. All children were pre and post tested on the day before treatment began and the day following treatment, respectively. The control group children were only identified and administered the pre and post tests. The same design and procedures were used with all EMG relaxation studies presented here.

In the first study, learning disabled elementary age boys were used. All met the Texas criteria and were in special resource classes for learning disabled children. (Bulletin, 711, 1976). Thirty-two children were randomly placed in the experimental or control group. The control group was only identified and administered the pre and post test as indicated.

Table 1 about here

Table 1 presents a summary of all data and results. The pretest scores attest to the similarities of the two groups. There were no significant differences between the groups on any pretest measure. Chronological ages, achievement, coordination, memory, I.Q. and handwriting legibility were essentially the same. However, following EMG biofeedback/ relaxation treatment the experimental group gained significantly over the controls on all dependent measures except arithmetic. A direct difference "t" test between the Difference scores of the two groups was utilized. Experimental children gained significantly over the control group ($p. < .01$) on both measures of reading and spelling. Error scores on the Bender, using the Koppitz (1963) scoring system decreased and auditory memory increased significantly for the experimental children over the controls. Even the Slosson I.Q. of the experimental group showed significant gains over that of the controls. Of course, handwriting legibility increased significantly in favor of the experimental children. That was to be expected because directed handwriting practice was part of the treatment. Figure 1 presents an example of increased handwriting quality.

Figure 1 about here

These significant and meaningful treatment results can be attributed to the EMG/relaxation intervention. With learned muscle tension reduction, the experimental children were able to cope more efficiently within the academic-like environment. It is suggested that the children did not learn the academic information during the treatment period, but that previously learned material became more easily accessible for application once the children were relaxed and less tense.

Throughout the investigation teachers and parents consistently remarked upon improved behavior of the experimental children in the classroom and at home. Statements such as, "he is finishing his work" or "he is less explosive" or "he is less impulsive" were typical. With the cognitive results and these impressionistic statements as a backdrop, it was decided to investigate possible positive changes in self-control behavior and self-concept.

The Child Behavior Rating Scale (Cassel, 1962) and the Tennessee Self-Concept Scale (Fitts, 1964) were added to the dependent measures. Twenty learning disabled elementary age boys were selected and administered the same biofeedback/relaxation treatment.

The Child Behavior Rating Scale was filled in by the parents during the time that the children were pre and post tested. The Scale consists of 78 items to which the parent is asked to respond in a 6 point scale ranging from yes (1) to no (6). The Profile yields adjustment scores in the subscales of "Self" "Home" "Social" "School" and "Physical" as well as a Total Adjustment Score.

The Tennessee Self Concept Scale is a 100 item self report. The subject answers questions on a one to five scale ranging from Completely false (1) to Completely true (5). In addition to Total Self Esteem score there are ten subscales of "Self Criticism," "Openness," "Self Acceptance,"Perception of Behavior," "Perception of Ability," "Feeling of Moral Worth," "Feeling of Adequacy," Feeling of Worth" as a "Family Member," Sense of Social Adequacy," and "Certainty of Self Perception."

Table 2 about here

Table 2 presents the results of biofeedback/relaxation training on the Behavior Rating and Self Concept Scale. A "t" test for related means was computed for each subtest score on both Scales. On the Behavior Rating Scale significant improvement ($p. < .01$) was obtained on all but one subscale. The exception was Social Adjustment which fell within the .05 level of confidence. Then the Tennessee Self Concept Scale yielded significant improvement ($p. < .05$ and $< .01$) on all but two subscales, "Self Acceptance" and "Perception of Ability." Finally, although not shown, achievement test scores increased significantly as in the previous studies.

In the studies mentioned to date, the investigations have been conducted within the clinical setting of the Diagnostic Education Center of the University by graduate students trained in biofeedback/relaxation procedures.

The next question addressed was, can essentially the same program be conducted in the public schools by school personnel? If so, can comparable results be obtained?

During the fall semester 1980 an attempt was made to implement the four part program in a nearby cooperating public school. Thirty elementary children classified as language learning disabled and attending special resource classes were obtained. They were randomly divided into two groups, experimental and control. The experimental children, with minor adjustments, were administered the same four part program for six weeks. The same cognitive and achievement tests were used as dependent pre and post measures to evaluate the effects of the program. All testing again was done by graduate students blind as to subject groups.

Three volunteer teachers administered the program to the 15 experimental children in groups of 5. The teachers received orientation and practice in equipment management and in developing relaxation exercises. An experienced graduate student assisted and supervised the treatment activities, but had no direct contact with children.

Table 3 summarizes the results. The experimental children made significant gains over the controls on all dependent measures except Slosson IQ and auditory memory. Although the magnitude of the gains are not as dramatic as those obtained in the clinical setting, they were statistically and practically significant.

Table 3

At this point we felt that we had developed a potentially viable supplementary treatment program for learning disabled children. With learned muscle tension reduction experimental children become more able to cope within their school and home environment. It must be remembered that no academic tutoring was involved other than handwriting. This learned muscular relaxation apparently brings about a lowered internal state of arousal which allows the child to recall more efficiently, attend more carefully and respond more effectively.

Consequently, the relaxation program was incorporated as a major delivery system of the Diagnostic Education Center. During the past three years we have "treated" 358 children. These children were manifesting learning and self-control problems in school but did not "fit" into a special education category. These children in groups of five to six were afforded the same treatment but for six weeks. The same pre-post test data were obtained and accumulated for consistency of evaluation of the treatment effects.

Table 4 summarizes the results. At pretest the mean chronological age was 11.3 years. With a mean IQ of 100.6 the expected achievement level would be sixth grade if the rule of five were applied. Pretest achievement scores indicate serious and consistent underachievement. Bender error scores (Koppitz, 1963) and handwriting quality were also low. Following and presumably as a result of treatment significant gains were made on all dependent measures except Arithmetic. Significant grade level gains were made on both measures of reading and spelling. Bender errors as determined by the Koppitz scoring method decreased and auditory memory and handwriting legibility increased.

Table 4

The results of these investigations are remarkably consistent, indicating significant muscle relaxation effects in the psychomotor and cognitive domains and there is some evidence that the affective domain is altered positively. Simply put, the process appears to be that as children become more relaxed they have more efficient access to previously learned material and can attend more effectively to the school work.

Also, as the children learn to relax they learn in bold relief that they can be in control of their muscular tension. It is postulated that the concept "I am in control" generalizes to other spheres of behavior. The results using the Child Behavior Rating Scale tends to corroborate this as do spontaneous statements by parents and teachers.

Before proceeding full steam ahead, however, some precautions are in order. First, long range effects must be evaluated. To date there is no data to support the contention that this learned muscle tension reduction and consequent improvement in cognitive abilities may be maintained over time, say six months or a year. Perhaps a few brief refresher sessions over a two year period would be most helpful.

Second, although these investigations utilized EMG preferred writing forearm training perhaps another location (frontalis) or biofeedback modality (temperature) would be even more efficient. Studies systematically investigating temperature control, alpha and 40 Hz training, GSR training and relaxation training without instrumentation must be conducted. All purport to increase awareness, self-control, and concentration. However, is one modality more efficient with children and is this effectiveness applied both to cognitive and behavioral self-control variables?

Another caution deals with distribution of practice, number of training sessions and length of each session. The program elements devised for the series of studies presented here were selected arbitrarily on an a priori basis for sake of convenience. Perhaps some frequent shorter sessions, at least at the beginning of training would be more conducive to gains.

It must be emphasized that biofeedback/relaxation training is not seen as supplanting curricular or program requirements, but as a supplementary procedure for selected children so that they may learn more easily and to counteract physiological stress reaction.

One final caution, the program when delivered to the public schools appears to require close monitoring by experienced personnel. One short workshop on implementation is insufficient. During the course of the program many questions and issues arise which must be attended to immediately.

These issues and others must be dealt with before biofeedback techniques are introduced indiscriminately into the schools. Otherwise biofeedback may well be relegated to the educational scrap heap, another unfulfilled promise.

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Table 1: Pre and Posttest Scores of Learning Disabled Experimental and Control Groups

Tests	Experimental			Control			Difference
	Pre	Post	Diff	Pre	Post	Diff	
C.A.	10.3	---	---	10.6			
Wide Range Achievement							
Reading	4.12	4.77	.65	4.34	4.42	.08	.57**
Spelling	3.84	4.46	.62	4.19	3.91	-.28	.90**
Arithmetic	4.17	4.22	.05	4.21	3.87	-.34	-.29ns
Gray Oral Reading	3.55	4.21	.66	3.69	3.55	-.14	.80**
Slosson Intelligence Test	104.3	111.8	7.5	105.3	106.2	.9	6.6**
Bender Gestalt	5.85	3.25	-2.60	4.76	4.32	-.44	2.16*
Slosson Drawing	72.9	85.8	12.9	75.5	78.9	3.4	9.5**
Auditory Memory	16.03	21.21	5.18	16.86	17.11	.25	4.93*
Handwriting	2.61	3.38	.77	2.69	2.91	.22	.55**
EMG	5.76	2.85	-2.91	—	—	—	—
	49% decrease						

n= 32 (16 per group)

* $p < .05$
** $p < .01$

Figure 1

Example of Handwriting Improvement Between Pre and Post Testing

Lee

I ke Zoo is a great place to go.
I like the ~~Ele~~ lions Best
of all its fun to watch
them to eat lions roar loun
and are scarry. ~~They~~ they get
excited and look ~~fie~~ fierce.
Some times I an afraid of them
Sometimes

Lee ☺ yeah you really tried this time.

Robert ran around roaring like a tiger. Ron told Robert to roar some more Ron and Robert raced around the room Rose heard the roaring and ran in Ron and Robert roared some more Roaring belongs in

Table 2: Pre and Posttest Scores on the Child Behavior Rating Scale and the Tennessee Self Concept Scale

Behavior Rating Scale	Pre	Post	Diff
Self Adjustment	83.4	95.0	11.6**
Home Adjustment	99.3	108.4	9.1**
Social Adjustment	95.6	106.5	10.9*
School Adjustment	42.6	53.1	10.3**
Physical Adjustment	28.4	32.2	3.8**
Total Adjustment	349.3	394.9	45.6***
Tennesse Self Concept			
Openness	105.3	120.0	14.7**
Self Acceptance	103.9	111.2	7.3ns
Perception of Behavior	102.6	107.4	4.8*
Perception of Ability	68.8	69.8	1.0ns
Feeling of Moral Worth	62.4	64.8	2.41*
Feeling of Adequacy	62.6	65.4	2.8*
Worth as Family Member	65.3	68.6	5.1**
Sense of Social Adequacy	59.0	63.6	4.6**
Certainty of Self Perception	118.7	113.6	-5.1**
Self Criticism	29.9	33.6	3.75*
Total Self Esteem	311.4	341.8	30.4**

n= 20 *p < .05 **p < .01 ***p < .001

TABLE 3

SUMMARY RESULTS OF

PUBLIC SCHOOL LLD CHILDREN

MEAN SCORES

	Experimental			Control			Difference	
	Pre	Post	Gains	Pre	Post	Gains		
Chronological Age	9.2	--	--	8.9	--	--	+ .3	
Slosson Intelligence	92.3	--	--	91.7	--	--	+ .6	ns
Wide Range Achievement Test								
Reading	1.79	2.13	+ .34	2.73	2.80	+ .07	+ .24	**
Spelling	2.24	2.63	+ .39	2.56	2.58	+ .02	+ .37	**
Arithmetic	2.36	2.57	+ .21	2.93	2.93	--	+ .21	*
Gray Oral Reading Test	1.75	2.07	+ .32	1.75	1.87	+ .12	+ .20	**
Auditory Memory	15.40	19.10	+3.70	11.90	15.80	+3.90	- .20	ns
Bender Motor Gestalt	3.90	2.90	-1.00	4.00	5.10	-1.10	+2.10	**
Handwriting	2.30	3.10	+ .80	2.50	2.80	+ .30	+ .50	*

N = 15 each

* $p < .05$

** $p < .01$

Table 4 : Pre and Posttest Scores of Non-Diagnosed Children

TESTS	Experimental		
	Pre	Post	Diff
C.A.	11.3		
Wide Range Achievement			
Reading	4.41	5.19	.78**
Spelling	3.26	4.09	.83**
Arithmetic	3.95	4.18	.23ns
Gray Oral Reading	3.93	4.63	.70**
Slosson I.Q.	100.6	107.1	6.5**
Bender	4.13	2.47	-1.65*
Auditory Memory	18.05	25.29	7.24**
Handwriting	2.28	3.51	1.23**
EMG	5.95	2.84	
	52% decrease		

n= 358

*p < .05
**p < .01

EEG ALPHA AND BETA TRAINING FOR LEARNING DISABLED BOYS WITH INTELLECTUAL VERBAL-PERFORMANCE IQ DISCREPANCIES

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In a series of investigations involving over 400 children (Carter and Russell, 1980) significant increases in reading but not in arithmetic skills were noted as a result of muscle relaxation biofeedback training. This program was based on following verbal instructions, assumed to be primarily a left hemisphere function.

As a result the authors conducted a pilot investigation (Carter and Russell, 1981). The subjects were four learning disabled boys with at least a 20 point discrepancy on the Wechsler Intelligence Scale for Children-Revised (WISC-R) with Verbal IQ low. The boys were given systematic left hemisphere training in alternating between the production of alpha (8-13 Hz) and beta (13-28 Hz).

Briefly, the theory was that in the normally functioning child, the left hemisphere shifts as needed from the resting state of 8-13 Hz activity to the sustained attention state involving the beta range of 13-28 Hz. Some children may have difficulty in making this shift. In particular, children who perform poorly on verbal, logical, and sequential tasks as compared to their average level of ability to perform right hemisphere tasks involving spatial and holistic processing, would be expected to have difficulty in making this shift.

The results of the pilot study tentatively supported the theory. Following left hemisphere EEG training to alternately shift from alpha to beta frequencies the subjects gained 12 points in Verbal IQ and significantly decreased the Verbal-Performance discrepancy.

Further support of this theory and assumptions comes through an evaluation of files of children evaluated at the Diagnostic Education Center. For the past five years the Center has administered comprehensive psycho-educational tests to children referred due to significant school learning difficulties.

Over 300 children a year are tested. The investigator randomly selected 25 folders of elementary school age children with a Verbal-Performance discrepancy, Verbal high and 25 with a Performance high discrepancy. Table 1 summarizes the results of reading and arithmetic scores on the Peabody Individual Achievement Test. Those with Verbal high IQ's scored over two years higher in reading than on the arithmetic test. The reverse was true with Performance high children. They scored 1.6 years higher in arithmetic than on the reading test.

Table 1 about here

Then 50 more were selected, 25 with reading scores one year or more above arithmetic scores and 25 with arithmetic scores higher by at least a year. Table 1 also summarizes these results. Children with higher reading than arithmetic scores also showed nearly 10 points higher Verbal IQ while children with higher arithmetic scores showed higher Performance IQ's.

This investigation is a logical extension of the pilot by enlarging the number of subjects and including right as well as left hemisphere training. Subjects with low Performance as well as low Verbal IQ's on the WISC-R were selected. Table 2 summarizes the experimental design. Ten subjects who were Verbal IQ low were randomly placed into one of two treatment groups, left hemisphere or right hemisphere training. Ten other subjects with Performance IQ low were also randomly placed in right and left hemisphere treatment groups.

The 20 subjects were selected from area public school learning disabled classes and met the following criteria:

- Right-handed males
- Nine through 11 age range
- Verbal-Performance discrepancy of 20 points or more on the WISC-R
- Met the Texas Education Agency criteria for inclusion in an LLD program and were enrolled in the program at their home school.
- Parents gave informed consent for participation.

The training procedures, derived from the earlier pilot study, were basically the same for all subjects. Each received individual EEG training in 30 minute sessions, two times per week for eight weeks. Those receiving left hemisphere training had active electrodes placed at O_1 and T_3 with ground at Fp1, while those receiving right hemisphere training had the positive electrodes placed at O_2 and T_4 with the ground at Fp2. Once attached to the EEG equipment, each child was asked to produce high levels of alpha (8-13 Hz) activity for five minutes then high levels of beta (13-28 Hz) for five minutes. This was continually alternated throughout the 30-minute training sessions. When the selected alpha or beta frequencies were present the child heard a tone. The original intention was to monitor and record percent time of alpha and beta production but a malfunction of the integrator prevented the collection of this data. In order to enhance production of alpha (in both left and right hemisphere training) the trainer suggested that the child let himself relax in order to turn on the tone indicating alpha production. For production of beta the trainer requested that the child attend to and answer simple questions such as, "listen and say these letters D-Q-Z" or "how are a table and a chair alike?," "different?" When changing from the production of alpha to beta the subject was asked to "put on his thinking cap." When shifting from beta to alpha he was asked "to relax."

In addition to these 30-minute treatment sessions each child was asked to practice passive relaxation at home three times a week for 15 minutes using pre-recorded audio cassette tapes.

The subjects were pre and posttested on the WISC-R by graduate students blind to the classification of the children.

The four working hypotheses that this training would act to decrease the magnitude of the Verbal-Performance IQ discrepancy were as follows:

- Verbal low: left hemisphere training should significantly increase Verbal IQ and have no effect on Performance IQ.
- Verbal low: right hemisphere training should have no effect on Verbal or Performance IQ's.
- Performance low: right hemisphere training should significantly increase Performance IQ and have no effect on Verbal IQ.
- Performance low: left hemisphere training should have no effect on Verbal or Performance IQ.

Table 2 about here

Table 2 summarizes the results as well as the experimental design. Essentially, the findings do suggest that specific treatment effects are elicited by specific treatment. A simple two-way analysis of variance revealed a significant ($P<.01$) overall treatment effect and a significant ($P<.01$) discrepancy decrease between pre and posttest. It must be assumed that these changes were a result of the treatment. An inspection of Table 2 further corroborates the specificity of treatments.

The Verbal low subjects receiving left hemisphere training gained a significant 12 points in Verbal IQ and only two on Performance and their discrepancy decreased from approximately 26 to 12 points. With right hemisphere training the gains were within the error term.

The results, as predicted, were the opposite with low Performance IQ subjects. No gains were made with left hemisphere training whereas over eight Performance IQ points were obtained with right hemisphere training. This significantly decreased the Verbal-Performance discrepancy by over seven points ($P<.01$). As expected, more overall gains were made in each cell but one (Verbal Low, left training) on the Performance Scale. This apparently is due to the practice effect which is greater for that scale than for the Verbal Scale.

Although the magnitude of the Performance low, right hemisphere training is not as great as for the Verbal low, left hemisphere training, it is significant at the .01 level. It is postulated that the Performance low, right training gains are lower because all instructions were verbal. There was no training input dealing solely with visualization, quantification, or organization. These results further support the earlier findings of specific effects being elicited by specific training of specific subject types.

These results have potentially great educational and behavioral significance and are consistant with David and Ornstein (1972) who reported that changes in EEG patterns correspond to different specialized thought processes. For instance, if a person is involved with a verbal task, his right hemisphere's alpha production increases due to the decreased use of that hemisphere.

Conversely, if the task is spatial the alpha production of the left hemisphere is increased. These results are also consistent with Barbara Brown (1977, p. 215) when she stated, "Inbala ces between the two types of cognitive style may be the cause of certain learning disabilities."

In theory, EEG biofeedback enables the child to reorganize and control specific brain wave patterns and learn to produce the mental state associated with that pattern. It is assumed that inefficient learning is a result of a significant Verbal-Performance IQ discrepancy and that if the discrepancy can be decreased learning efficiency in children will increase. The literature indicates that one significant diagnostic sign of learning disabilities in children is a significant Verbal-Performance discrepancy. Over half of diagnosed learning disabled children have at least a 20 point discrepancy.

The implication is clear that there is a specific hemispheric relationship with intellectual abilities and educational attainment. It is conjectured that one means of dealing with learning disabled children is to decrease the Verbal-Performance IQ discrepancy, if one exists. When the two hemispheres function equally well the child may learn more efficiently. Thus specific EEG hemisphere training may well be dealing with a basic source of learning disability rather than with an observable symptom, poor academic progress. The next step in the investigative sequence is to determine the effects of hemispheric training upon academic attainment in reading and arithmetic.

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Table 1, Reading and Arithmetic Achievement
of IQ Discrepant Children

	Verbal High		Performance High		Reading High		Arith High	
C. A.	10.1		10.5		9.9		10.2	
Verbal IQ	103.7	(18.0)	86.6	(20.9)	101.3	(14.6)	104.6	(19.8)
Performance IQ	85.3		107.5		86.7		84.8	
Reading	5.9	(2.3)	3.8	(1.6)	4.9	(1.7)	3.4	(1.8)
Arithmetic	3.6		5.4		3.2		5.2	
	n=25		n=25		n=25		n=25	

Table 2, Summary of Mean IQ,
Difference and Gain Scores
For all Groups

IQ Discrepancy		Left Training Hemisphere				Right Training Hemisphere		
		Pre	Po	Gain		Pre	Po	Gain
Verbal Low	V:	80.4	92.4	12.0	V:	79.0	82.4	3.4
	P:	106.2	104.2	2	P:	97.4	102.0	4.6
	DIF:	25.8	11.8	14.0	DIF:	18.4	19.6	+1.2
		Pre	Po	Gain		Pre	Po	Gain
Performance Low	V:	103.8	105.6	1.8	V:	98.8	99.8	1.0
	P:	84.0	88.4	4.4	P:	77.2	85.6	8.4
	DIF:	19.8	17.2	2.6	DIF:	21.6	14.2	7.4